





LEARNING OBJECTIVES:

- 2.12.01 List the applicable agencies which have regulations that govern the transport of radioactive material.
- 2.12.02 Define the following terms used in DOT regulations:
- a. LSA
 - b. Limited Quantity
 - c. Transport Index
 - d. Exclusive Use
 - e. Closed Transport Vehicle.
- 2.12.03 List methods that may be used to determine the radionuclide contents of a package.
- 2.12.04 Describe the necessary radiation and contamination surveys to be performed on packages and state the applicable limits.
- 2.12.05 Describe the necessary radiation and contamination surveys to be performed on exclusive use vehicles and state the applicable limits.
- 2.12.06 Identify the proper placement of placards on a transport vehicle.
-  2.12.07 Identify inspection criteria that should be checked prior to releasing a shipment at your site.
-  2.12.08 Describe site procedures for receipt and shipment of radioactive material shipments.
-  2.12.09 List the actions required at your site if a shipment is received exceeding radiation or contamination limits.
-  2.12.10 Describe the proper step-by-step method for opening a package containing radioactive material at your site.

RADIOACTIVE MATERIAL SHIPMENT REGULATIONS

The basis behind the regulations governing the packaging and shipping of radioactive material is to keep radiation and radioactive material from affecting the environment during transportation and to keep the environment from affecting the integrity of the radioactive material.

The package itself is to be designed and constructed to be the effective barrier between the environment and the radioactive material, thus most of the regulatory restrictions apply to the package and the method of shipment used to transport the package.

To reduce any potential hazard, the regulatory requirements become more restrictive as the quantity, concentration, and potential hazard of the radioactive material increases.

2.12.01 List the applicable agencies which have regulations that govern the transport of radioactive material.

Regulatory Structure. Numerous governmental agencies have jurisdiction over the transfer and shipment of radioactive material from nuclear facilities. The primary organizations are:

- U.S. Department of Energy
- U.S. Nuclear Regulatory Commission
- U.S. Department of Transportation, Hazardous Material Bureau
- U.S. Postal Service
- U.S. Coast Guard
- Federal Aviation Administration
- State transportation departments or radiation health bureaus.

U.S. Department of Energy. The U.S. Department of Energy (DOE) establishes regulations to protect the public health and safety from undue risk from DOE activities. These regulations are in the form of the DOE RCM or DOE Orders. DOE Orders applicable to packaging and transportation of radioactive material include:

- DOE Radiological Control Manual - establishes when DOE or DOT limits for contamination should be used and states other requirements (Article 423).

- DOE Order 1540.1--DOE Order 1540.1 establishes DOE policies and procedures for the management of materials transportation activities, including traffic management, for other than intrabuilding and intrasite transfers. It contains general requirements related to all transportation activities, not just hazardous or radioactive materials.
- DOE Order 1540.2--DOE Order 1540.2 establishes administrative procedures for the certification and use of radioactive and other hazardous materials packaging by DOE.
- DOE Order 5480.3--DOE Order 5480.3 establishes standards and requirements for the packaging and transportation of hazardous (including radioactive) materials, substances and wastes. This Order requires that packages for radioactive materials meet the NRC standards in 10 CFR 71 and imposes additional restrictions.
- DOE Order 5480.4--DOE Order 5480.4 lists laws, regulations, and standards issued by organizations other than DOE that are either required or recommended to be followed in conducting DOE operations. This Order lists the following standards related to shipment of radioactive materials:
 - Mandatory as a Result of Federal Statutes--49 CFR 170-179, DOT Hazardous Materials Regulations 10 CFR 71, NRC Regulations on Packaging of Radioactive Materials for Transport
 - Mandatory as a Matter of DOE Policy--IAEA Safety Series No. 6, Regulations for the Safe Transport of Radioactive Material International Air Transport Association Restricted Article Regulations

The Order also lists several publications from Oak Ridge National Laboratory, the American National Standards Institute, and Nuclear Regulatory Commission Regulatory Guides as non-mandatory References on Good Practice.

- DOE Order 5820.2A--DOE Order 5820.2A establishes policies, guidelines, and minimum requirements by which DOE manages its radioactive wastes.

U.S. Department of Transportation. The DOT regulates transportation by air, water, rail, and highway. The Materials Transportation Bureau has established rules governing the packaging and transport of hazardous material, including radioactive material.

These regulations are contained in 49 CFR 170 - 179 and are applicable to any person

who transports, or ships, a hazardous material. Even though most of the requirements for shipping radioactive material are located in Part 173, the other sections of DOT regulations must not be overlooked.

Regulatory Compliance. There are many regulations and documents from several agencies that govern the transfer and transport of radioactive material. Compliance with all regulations, not just those from one agency, is required to transfer and shipment of radioactive material. The number of regulations involved depends upon the chosen mode of transport and the quantity of radioactive material. Each individual or group assigned the responsibility of transferring and shipping radioactive material must maintain a complete set of current regulations from all applicable agencies as well as other supporting regulatory guides, licenses and clarifying documents.

Keep in mind that most regulations usually contain exemptions and may contain more restrictive clauses. For example, the DOT may exempt some shipments of low quantities and types of radioactive material from their regulations. The DOT exemption, however, does not automatically exempt the material from DOE requirements. It is best to be aware of the requirements from all agencies to avoid citations for using one specific exemption that is not recognized by the other agencies.

- 2.12.02 *Define the following terms used in DOT regulations:*
- a. *LSA*
 - b. *Limited Quantity*
 - c. *Transport Index*
 - d. *Exclusive Use*
 - e. *Closed Transport Vehicle.*

DEFINITION OF TERMS

In order to understand the regulations, it is necessary to understand the basic language and limits established in the regulations. The following definitions are simplified and must be used for training purposes only. Refer to the referenced regulation sections for the "official" definition and requirements.

Radioactive Material (49 CFR 173.403). Material or combination of materials which spontaneously emit ionizing radiation. Material with an estimated specific activity of less than 0.002 $\mu\text{Ci/gram}$, essentially uniformly distributed, is not considered radioactive only by the U.S. DOT regulations.

Special Form (49 CFR 173.403). A term used to describe encapsulated radioactive materials which will withstand a series of tests designed to represent a worst case accident.

Facilities wanting to ship material as "Special Form" require a "certificate" stating that radioactive material in this category has passed the required tests.

Normal Form (49 CFR 173.403). Any radioactive material which is not Special Form. In other words, this includes most radioactive material shipped except encapsulated sources with the "Special Form" certification.

Package (49 CFR 173.403). The packaging and its radioactive contents.

Packaging 49 CFR 173.403. The container and wrappers and the contents, but not the radioactive material. More specifically, the packaging is the material/equipment which

prevents the release of the radioactivity to the environment during shipment.

Low Specific Activity (LSA) (49 CFR 173.403). A classification of radioactive material expressed as a concentration of activity (mCi/g) or surface contamination (dpm/100 cm²), below which certain exemptions are granted in regard to shipping.

This includes, but is not limited to, materials of low radioactivity concentration (such as activated metal, solid or liquid plant waste, sludges, and material such as wood, paper, and glassware which have absorbed or internal activity).

Exemptions. LSA transported in Exclusive Use (Sole Use) shipments are exempt from more restrictive "specification" packaging, but must be packaged in strong, tight packages so that there is no leakage of radioactive material under conditions normally incident to transportation (49 CFR 173.411).

The U.S. DOT exception to the exemption is that bulk shipments of liquid radioactive material must be shipped in specification tank trucks or tank cars (49 CFR 173.425).

Quantities. When the material does not qualify as LSA, it must be shipped under the more restrictive sections of the regulations which specify requirements based on the quantity of radioactive material in each package. The limits are in Curies and are based on the A₁ and A₂ limits. A discussion of these limits and associated packaging requirements follows:

Limited Quantities, Instruments, and Articles (49 CFR 173.421 + 173.423).

Summarizes the activity limits for limited quantities, instruments, and articles.

These quantities are exempt from specification packaging but must be packaged in strong, tight packages so that there will be no leakage of radioactive materials under conditions normally incident to transportation. The outside of the inner packaging, or if there is no inner packaging, the outside of the packaging, must bear the marking "Radioactive." A description of the contents must also be on, in, or forwarded with the package (49 CFR 173.421-1). For additional requirements, refer to 49 CFR 173.421.

Type A Quantity. An amount of radioactivity which does not exceed the A₁ value for special form radioactive material or the A₂ value for normal form radioactive material. Type A quantities must be packaged in Type A packaging or any Type B packaging (40 CFR 173.431 and 173.415). Typically, the Type A packaging requirements can be met by using the performance-based DOT Specification 7A Type A general packaging.

A complete certification and supporting safety analysis demonstrating compliance with the specification 7A shall be maintained on file by the shipper and provided to DOT at their request (49 CFR 173.415).

MLM-3245, "DOE Evaluation Document for DOT 7A Type A Packaging" of March, 1987 from Monsanto Research Corporation, contains descriptions of containers, specifications and restrictions, and test results proving that many DOT specification containers meet the environmental and test conditions established for DOT Specification 7A. Among the most frequently used containers reviewed in the report is the DOT Specification 17H 55 gallon Steel Drum.

Type A quantities of LSA material shipped mixed lading must also be packaged in Type A packaging.

Type B Quantity. An amount of radioactive material greater than a Type A Quantity. Type B Quantities must be packaged in Type B packaging which meets the pertinent requirements of 49 CFR. Each Type B package design must be submitted to the NRC for approval and issuance of a "Certificate of Compliance" by the NRC. The Certificate of Compliance contains the details and limitations (e.g., Curie limit) for using the Type B package.

10 CFR 71.101, Subpart H, states the quality assurance requirements for using Type B certified packages for shipment of Type B Quantities of radioactive material. Procedures must be followed and records maintained. Each licensee must inform the NRC of the certified Type B packages that the licensee intends to use even if the package is supplied by a contractor.

Fissile Material (49 CFR 173.403). Any of the radionuclides Pu-238, Pu-239, Pu-241, U-233, and U-235.

Fissile material is placed in three classifications according to controls necessary to ensure nuclear criticality safety.

- Fissile Class I - no controls necessary.
- Fissile Class II - package contents and number of packages limited.
- Fissile Class III - special arrangements between shipper and carrier are necessary. Packaging requirements for fissile class II and III materials are relatively complex, with many provisions and exemptions. The most significant is the exemption for quantities of less than 15 grams.

These exemptions are for the U.S. DOT regulations and do not exempt compliance with facility Acceptance Criteria.

Exclusive Use (Sole Use) (Full Load) (49 CFR 173.403). A shipment that is loaded at the plant and is not unloaded (or the cargo shifted in any way) until it has reached its final destination. No other commodity can be shipped with the radioactive material.

Closed Transport Vehicle (49 CFR 173.403). A vehicle equipped with a securely attached exterior enclosure that restricts the access of unauthorized personnel to the radioactive material. The enclosure can be permanent or temporary and can even be "see-through." However, the enclosure must limit access from top, sides, and ends. For example, a flat bed truck can be a closed transport vehicle if a wire/mesh/chain or other securely attached barrier is used to restrict access to the load.

Mixed Lading. The term used to describe shipments of radioactive material which are, can, or may be shipped on the same vehicle or temporarily stored at a terminal with other commodities. Obviously, more restrictions and rules must and are applied to packages of radioactive material which are shipped Mixed Lading.

Transport Index (49 CFR 173.403). A classification which identifies the radiation levels being emitted from a package sent as Mixed Lading. The Transport Index (T.I.) is the numerical equivalent of the highest radiation level (in mrem/hr) measured at a distance of 1 m (3.3 ft) from any surface of the package. The number expressing the transport index shall be rounded up to the next highest tenth (e.g., 1.01 becomes 1.1).

APPLICATION OF REGULATORY REQUIREMENTS

The following is a general discussion of the steps followed to:

- Determine the type and quantity
- Package
- Mark, label, and placard
- Surveys of packages and transport vehicles
- Prepare shipping papers.

These steps are for a typical shipment of radioactive material. This discussion is not all inclusive of every regulatory requirement and is intended only as an explanation of the

major transportation considerations.

Each individual responsible for transfer, packaging and shipping should become familiar with the regulations and other regulatory documents and establish clear, step-by-step instructions in the form of procedures for workers to follow.

If the radioactive material is in a physical or chemical form that constitutes a hazard in addition to the radiological hazard (such as an acid, base, toxic or flammable substance), additional regulations could apply to the packaging, shipment and disposal of the material. This type of waste is known as "Mixed Hazardous Waste." Additional requirements for Mixed Waste are specified in DOT, EPA, and state regulations.

2.12.03 *List methods that may be used to determine the radionuclide contents of a package.*

Radioactive Contents. In order to determine packaging, labeling and other requirements for shipping radioactive material, the radionuclide content of the material must be known. This includes the identity and quantity of each isotope.

Identification and quantitative measurement of most gamma emitting isotopes is fairly simple using gamma energy spectroscopy techniques. It is much more difficult to identify and measure beta and alpha emitting radionuclides. Recognizing these problems, the NRC issued technical papers and other guidance on radionuclide identification techniques. The NRC position papers state that there are four basic methods which are considered acceptable for radionuclide identification. These methods are materials accountability, classification by source, gross radioactivity measurements, and direct measurement of individual radionuclides.

The materials accountability technique is primarily applicable to wastes and involves determining the quantity of radioactive material contained within a volume by comparing the amount of radioactive material entering and exiting a given process. For example, if the concentration of airborne radioactivity entering and leaving a HEPA filter is measured and the air volume passing through the filter is known, the difference can be assumed to be retained in the filter.

The classification by source method involves determining the radionuclide content through knowledge and control of the source of the material. For example, a sealed calibration source that was leaking and had to be returned to the manufacturer could be assumed to

contain the same isotope and quantity of radioactive material as when it was received, provided that source control and inventory procedures are adequate to ensure traceability of the material (i.e., to prove that the sealed source being shipped is the same one that was received).

Measurement of gross radioactivity (e.g., based on a dose rate from a container) is an acceptable method for radionuclide identification provided that:

- The gross radioactivity measurements are correlated to the actual radionuclides in the material.
- The gross measurement is initially correlated to actual radionuclide content and periodically verified.

The final acceptable method for determining radionuclide content is by direct measurement. In this method, individual gamma emitting radionuclides are directly measured using gamma spectroscopy. Concentrations of other radionuclides are projected by ratioing to concentration of gamma emitting radioisotopes. The ratios are usually referred to as scaling factors. This method is essentially the same as the gross measurement method except for the quantitative measurement of the individual gamma emitting isotopes.

2.12.04 Describe the necessary radiation and contamination surveys to be performed on packages and state the applicable limits.

Package Radiation Surveys and Limits.

Radiation Surveys (49 CFR 173.441). Measure the radiation levels at all points on the surface of the package (for small packages less than a 55 gallon drum in size, a "contact" reading is not adequate -- it must be translated to a surface dose rate.)

Survey at 1 m (3.3 ft) from the surface of the package to determine the maximum radiation levels to establish the Transport Index (T.I.) for "Mixed Lading" shipments. The following radiation limits apply to packages:

Table 1 - DOT Limits on Package Radiation Levels

Type shipment	Level	
Exclusive Use	1,000 mrem/hr	On accessible external surfaces of the package
(Closed Transport Vehicle)		
Mixed Lading	200 mrem/hr	On surface of package
	10 mrem/hr	1 meter (T.I. of 10)
Limited Quantity	0.5 mrem/hr	At any point on the package surface

Contamination Surveys: Off-site shipments by non-DOE conveyance. Contamination surveys of the package can be performed by normal disc smear surveys, or for large containers more effectively with paper towel swipes, measured in a low background area (<0.1 mR/hr) with a GM pancake probe. A limit in cpm can be established which will be equivalent to the normal dpm/100 cm² limits.

2.12.05 *Describe the necessary radiation and contamination surveys to be performed on exclusive use vehicles and state the applicable limits.*

Table 2 - DOT Contamination Limits

Type Shipment	* External surface limits
Exclusive Use, Closed Transport Vehicle Used Only For Radioactive Material	22,000 beta-gamma 2,200 alpha
Exclusive Use During Transport	22,000 beta-gamma 2,200 alpha
At the Beginning of Transport	2,200 beta-gamma 220 alpha
Other Shipping Modes	2,200 beta-gamma 20 alpha

DOT Regulation 49 CFR 173.427 contains the contamination control requirements for packaging which previously contained radioactive material but has been emptied of the contents as far as practical. If the package meets all of the requirements in that section, including affixing an "EMPTY" label to the packaging the internal surface contamination limits are as follows:

*220,000 dpm/100 cm² beta-gamma

*22,000 dpm/100 cm² alpha

*Limits for certain isotopes, including most transuranics, are a factor of 10 lower.

This regulation applies to reusable casks. Note that the packaging must also meet the previously discussed external surface limits.

Contamination Surveys: On-site and off-site shipments by DOE conveyance.

49 CFR 170 through 180 describe requirements for inspecting and surveying packages, containers and transport conveyances prior to off-site transport. The 49 CFR 173 contamination values shall be used as controlling limits for off-site shipments transported by non-DOE conveyances. These limits also apply to on-site transfers of shipments by

non-DOE conveyances received from or destined to off-site locations.

Table 3 contamination values shall be used as controlling limits for on-site and off-site transportation when using a DOE conveyance. When a shipment is received from an off-site destination, in or on a non-DOE conveyance, the 49 CFR contamination values shall be used when transfers are made in a DOE conveyance from the on-site receiving location to the ultimate on-site destination.

Table 3 - Summary of Contamination Values

NUCLIDE (See Note 1)	REMOVABLE (dpm/100 cm²) (See Notes 2 & 3)	TOTAL (FIXED + REMOVABLE) (dpm/100 cm²)
U-natural, U-235, U-238 and associated decay products	1,000 alpha	5,000 alpha
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. Includes mixed fission products containing Sr-90.	1,000 beta-gamma	5,000 beta-gamma
Tritium organic compounds, surfaces contaminated by HT, HTO and metal tritide aerosols	10,000	10,000

Table Notes:

1. The values in this Table apply to radioactive contamination deposited on, but not incorporated into the interior of the contaminated item. Where contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for the alpha-and beta-gamma-emitting nuclides apply independently.

2. The amount of removable radioactive material per 100 cm² of surface area should be determined by swiping the area with dry filter or soft absorbent paper while applying moderate pressure and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. For objects with a surface area less than 100 cm², the entire surface should be swiped, and the activity per unit area should be based on the actual surface area. Except for transuranics, Ra-228, Ac-227, Th-228, Th-230, Pa-231 and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual contamination levels are below the values for removable contamination.
3. The levels may be averaged over 1 square meter provided the maximum activity in any area of 100 cm² is less than three times the values in Table 3.

Package Marking, Sealing and Labeling.

LSA Packages Shipped Exclusive Use. LSA packages sent Exclusive Use must be stenciled or otherwise marked: "Radioactive---LSA" (49 CFR 173.425(b)(8)).

Limited Quantities. Limited Quantity packages must have the inner packaging or when there is no inner packing, the outside of the packaging marked: "Radioactive" (49 CFR 173.421(d)).

When sent by mail the inner container must be marked: "Radioactive Material - No Label Required."

Type A Packages.

Type A packages must meet the following conditions:

- a. Ensure that the smallest external dimension is not less than 10 cm.
- b. Be sealed with a device not easily breakable which will reveal opening or tampering.
- c. Meet the physical design requirements specified in 49 CFR 173.412.
- d. Marked (in contrasting color to that of the container) with:
 - The proper shipping name and UN identification number (49 CFR 172.301). Table 4 contains examples of proper shipping

names and UN numbers.

- The name and street address of the shipper using no abbreviations. This requirement, however, does not apply to an Exclusive Use Type A shipment (49 CFR 172.306).
- e. Labeled (on opposite sides) depending on the radiation levels with the appropriate "White I," "Yellow II," or "Yellow III" labels. Refer to Figure 1 for label specifics (49 CFR 172.403).

LSA Packages Sent Mixed Lading. Type A packaging is required for LSA materials shipped mixed lading. However, packages containing LSA material are exempt from the following:

- The 10 cm smallest dimension requirement.
- The need for a tamper-indicating seal.

Type B Packages.

Type B package labeling and marking must meet the following requirements:

- a. Follow the same requirements as those described for Type A packages.
- b. Follow any additional sealing, labeling, and marking requirements contained in the NRC Certificate of Compliance for the package.

Table 4 - Examples of Proper Shipping Names and Identification Numbers.

I.D. Number	Proper shipping name
UN2908	Radioactive Material, Empty Packages
UN2918	Radioactive Material, Fissile, n.o.s.
UN2911	Radioactive Material, Instruments and Articles
UN2910	Radioactive Material, Limited Quantity, n.o.s.
UN2912	Radioactive Material, Low Specific Activity, n.o.s.
UN2982	Radioactive Material, n.o.s.
UN2974	Radioactive Material, Special Form, n.o.s.

Surveys of Transport Vehicle. Radiation and contamination surveys should be made when an Exclusive Use transport vehicle arrives at the site to ensure that the vehicle is not exceeding applicable DOT limits. If found to be above these limits, the vehicle should not be loaded until properly decontaminated and the owner of the transport vehicle informed of the violation. During loading, exclusive use transport vehicles should be frequently surveyed to avoid the problem of rearranging the load after it is discovered that the radiation levels are above limits.

Vehicle Radiation Surveys. Radiation surveys should be performed at the appropriate locations to ensure that the following limits are not exceeded:

Exclusive Use Closed Transport (49 CFR 173.441)

- 200 mrem/hr contact with any external surface (including top and bottom)
- 10 mrem/hr at 2 meters from any point on the sides, front and rear.
- 2 mrem/hr in normally occupied areas (e.g. driver and sleeper).

Exclusive Use Open Transport (49 CFR 173.441)

- 200 mrem/hr contact with outer edges, upper surface of load and bottom of vehicle.
- 10 mrem/hr at 2 meters from the vertical plane projected from the outer edges.
- 2 mrem/hr in normally occupied areas (e.g. driver and sleeper)

Normal Exclusive Use Vehicle Being Returned to Service (49 CFR 173.443(c))

- 0.5 mrem/hr on each accessible surface.

Empty "Radioactive Materials Use Only" Vehicles (49 CFR 173.443(d)(1))

- 10 mrem/hr contact with interior surface
- 2 mrem/hr at 1 meter from interior surfaces.

Mixed Lading Shipments

- Package T.I. limit of 10
- Sum of all package T.I.s must be less than or equal to 50
- Minimum distances required:
 - 7 ft to occupied zones
 - 36 ft to undeveloped film
 - if too restrictive, exemptions are listed in the regulations.

Outgoing Vehicle Contamination Surveys. DOT regulations do not specify contamination limits for transport vehicles other than those designated exclusive use. It is assumed that if packages loaded onto vehicles are kept within their contamination limits, the vehicle will be within the package contamination limits. Contamination surveys of the packages should be conducted at the time of loading to ensure that they have not become contaminated in storage or through handling.

Even though DOT regulations do not specifically require contamination surveys for non-exclusive use vehicles, it is good radiological control practice to perform such surveys to ensure that no contamination is spread to offsite areas. Prior to releasing a non-exclusive use vehicle, survey the bed of the truck, floor of the cab, controls in cab, tires, and other areas which could have become contaminated during loading.

DOT Regulation 49 CFR 173.443 does require that contamination surveys be performed

on specified exclusive use vehicles. If the vehicle was used to transport packages contaminated to more than 2,200 or 220 dpm/100 cm² for beta-gamma and alpha, respectively, the vehicle must be surveyed and found to be less than 2,200 and 220 dpm/100 cm² beta-gamma, and alpha, respectively before the vehicle can be returned to service. If certain radionuclides, including transuranics, have previously been transported by the vehicle, the lower limits for those isotopes of 220 dpm/100 cm² beta-gamma and 22 dpm/100 cm² alpha should be applied.

2.12.06 *Identify the proper placement of placards on a transport vehicle.*

Proper Placarding of Transport Vehicle.

Requirements

Placards are required for:

- Exclusive Use shipments of LSA (49 CFR 173.425(b)(7)).
- Shipments which contain packages properly identified with a "Radioactive Yellow III" label (49 CFR 172.504(a)). Do not over-label or placard a vehicle unnecessarily. Application of such signs when the hazard does not exist is a violation of regulations (49 CFR 172.401).

Description of Placard. The radioactive placard is diamond shaped with "Radioactive" in black centered across it on a white background. The upper portion of the sign has a black radiation symbol on a yellow background (49 CFR 172.556). The placard must be fastened to all four sides of the vehicle (49 CFR 172.504(a)).

| Location of Placards on Transport Vehicle. Placards must be on all four sides of the
| vehicle. If a tractor is disconnected from the trailer, placards must be on all four sides of
| the trailer otherwise the front placard can be on the tractor. After the shipment has been
| officially received on the receivers property, it is usually posted in accordance with regular
| posting (Radiation Area, High Radiation Area, Contamination Area, etc.)

2.12.07 *Identify inspection criteria that should be checked prior to releasing a shipment at your site.*

Inspection Prior to Release of Shipment

(Insert site specific information here)

Documentation. For all shipments, other than by mail, the shipping papers must adhere to the requirements of 49 CFR 172.200 through 172.204.

Verification of Receiving Facility's Authorization to Receive the Material. 10 CFR 30.41 and 10 CFR 70.42 require that before transferring byproduct and/or special nuclear material, respectively, the shipper must verify that the receiving facility has a license that authorizes the receipt of the material being shipped.

Although these restrictions only apply to NRC licensees, it is good practice to perform the same verification prior to shipping radioactive material to other DOE facilities. Some DOE facilities that normally use only a few isotopes may not have the proper training or instruments to safely receive and control the material. It must also not be assumed that other government agencies are exempt from NRC regulations and license restrictions. Most Department of Defense facilities that use radioactive materials, for example, are licensed by the NRC.

VIOLATIONS OF REGULATIONS

Increased public awareness of issues concerning the nuclear industry including the associated activities of shipping radioactive material and disposing of radioactive waste, has led to increased political activity in creating new laws, regulations, and acceptance criteria along with increased inspection activities. Violations of regulations are considered "serious." Many personnel within the nuclear industry who are not aware of all of the regulatory requirements are putting themselves, and others, at risk. Ignorance of the requirements and lack of attention to detail has led to many violations. Keeping current with the latest requirements, periodically reviewing all requirements, creating and enforcing current procedures to clarify methods of compliance, and inspecting shipments before they leave the facility is no longer a part time job. Personnel assigned the responsibility of packaging and shipping radioactive material must realize the seriousness

and consequences of even a minor infraction of the regulations.

Frequent violations of DOT regulations include:

- Leaking packages
- Contaminated packages and vehicles
- Radiation levels exceeding limits in vehicle cabs, underneath vehicles, and other limits
- Load not securely fastened
- Mechanical deficiencies in the vehicles
- Instructions not provided to carrier for maintaining "exclusive use" of vehicle
- Improper package closure
- Improper packagings for the type or quantity of radioactive material
- Improper or missing markings, labels or placards
- Incomplete and incorrect information on shipping papers.

2.12.08 Describe site procedures for receipt and shipment of radioactive material shipments.

RECEIPT OF RADIOACTIVE MATERIAL

It is necessary that packages of radioactive material be expeditiously delivered and that the existence of a leak be rapidly detected to minimize radiation exposure to transportation and plant personnel, to minimize the spread of contamination and to aid in identifying personnel and property that may have been exposed or contaminated during the transport of the radioactive material. Prompt and careful inspection of packages containing radioactive material is required by DOE Order 1540.1. If the inspection results in even the suspicion that the package may have been damaged in transit, surveys for removable contamination are required.

(Insert site specific information here)

SHIPMENT OF RADIOACTIVE MATERIAL

(Insert site specific information here)

2.12.09 *List the actions required at your site if a shipment is received exceeding radiation or contamination limits.*

SHIPMENT EXCEEDING LIMITS

Action When Limits Are Exceeded. If it is known, assumed, or suspected that the delivering vehicle or packages are contaminated, the delivering carrier, all intermediate carriers and the shipper must be notified immediately so that potentially contaminated vehicles can be withdrawn from service and checked. Loading docks and terminals through which the package passed in transit must also be surveyed. If any contamination is found on package surfaces, it is important to check any areas, equipment or personnel who may have become contaminated handling the package. Depending on the extent of contamination, the incident may also require notification to DOE Headquarters under the Unusual Occurrence Reporting system and could result in activation of the Radiological Assistance Plan. If a package was received from an NRC licensee, the director of the NRC Inspection and Enforcement Regional Office should also be notified.

(Insert site specific information here)

2.12.10 *Describe the proper step-by-step method for opening a package containing radioactive material at your site.*

OPENING PACKAGES OF RADIOACTIVE MATERIAL

It is good radiological control practice to establish, maintain, and follow procedures for opening packages containing radioactive material.

(Insert site specific information here)

SUMMARY

Radioactive material which is to be transported from one location to another must be properly packaged, surveyed, labeled and documented. Currently there are approximately 50,000 weekly shipments of radioactive material in the U.S. Strict adherence to shipping requirements is requisite to maintain high levels of safety.

REFERENCES

1. DOE Order 5400.3
2. 49CFR, Parts 100-177, Transportation